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EXAMINER

CHEN, ERIC BRICE

ART UNIT

PAPER NUMBER

1765

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Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No.	Applicant(s)	
	10/662,215	GORANTLA ET AL.	
	Examiner	Art Unit	
	Eric B. Chen	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 12 September 2003.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-33 is/are pending in the application.
- 4a) Of the above claim(s) 30-33 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-29 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☒ Claim(s) 1-33 are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>10/9/03</u> . | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Election/Restrictions*

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
  - I. Claims 1-29, drawn to a composition, classified in class 252, subclass 79.1.
  - II. Claim 30-33, drawn to a method, classified in class 216, subclass 88.
2. The inventions are distinct, each from the other because of the following reasons: Inventions I and II are related as product and process of use. The inventions can be shown to be distinct if either or both of the following can be shown: (1) the process for using the product as claimed can be practiced with another materially different product or (2) the product as claimed can be used in a materially different process of using that product (MPEP § 806.05(h)). In the instant case, the aqueous composition can be used to polish or etch any structure without the application of chemical mechanical planarization method.
3. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper. Moreover, because these inventions are distinct for the reasons given above and the search required for Invention I is not required for Invention II, restriction for examination purposes as indicated is proper.
4. During a telephone conversation with Peyton C. Watkins on June 20, 2005, a provisional election was made with traverse to prosecute Invention I, claims 1-29.

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Affirmation of this election must be made by applicant in replying to this Office action.

Claims 30-33 are withdrawn from further consideration by the examiner, 37

CFR 1.142(b), as being drawn to a non-elected invention.

5. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

### ***Claim Objections***

6. Claim 14 is objected to because of the following informalities: "process" apparently should be -- composition --. Appropriate correction is required.

### ***Claim Rejections - 35 USC § 102***

7. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

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8. Claims 1-9, 14-17, 20, 24, and 26-29 are rejected under 35 U.S.C. 102(e) as being anticipated by Mueller et al. (U.S. Patent No. 6,319,096).

9. As to claim 1, Mueller discloses an aqueous composition for chemical mechanical planarization of a wafer or film using a fixed polishing pad, the composition comprising: (a) from about 0.2 to about 10 weight % of abrasive nanoparticles (column 2, lines 16-18) having an average particle size of between about 10 and about 200 nanometers (column 2, lines 19-22); and (b) from about 90 to about 99.8 weight % of water (column 2, lines 16-18; column 5, lines 13-17); wherein the pH of the composition is between about 3 and about 5 or between about 9 and about 12 (column 5, lines 18-21), and the composition does not comprise polyelectrolytes. It should be noted that the Mueller reference does not expressly disclose "polyelectrolytes."

10. As to claim 2, Mueller discloses that the number of particles with a diameter greater than about 100 nanometers is less than about 1 weight % (column 3, lines 6-10).

11. As to claim 3, Mueller discloses that the nanoparticles are ceria (column 2, lines 49-50).

12. As to claim 4, Mueller discloses that the fixed polishing pad is a fixed abrasive pad (column 5, lines 51-52). APPLIED MATERIALS MIRRA® polishing pads are fixed abrasive pads. See Wolf, *Silicon Processing for the VLSI Era*, Vol. 4, Lattice Press (2002), pages 382-84 ("Wolf IV").

13. As to claim 5, Mueller discloses that the pH of the composition is between about 9 and about 12 (column 5, lines 18-21). See also Wolf IV, page 369.

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14. As to claim 6, Mueller discloses that the amount of ceria nanoparticles is from about 0.2 to about 3 weight % (column 2, lines 28-32).

15. As to claim 7, Mueller discloses that the nanoparticles are silica (column 2, lines 49-50).

16. As to claim 8, Mueller discloses that the pH of the composition is between about 9 and about 11 (column 5, lines 18-21). See *also* Wolf IV, page 369.

17. As to claim 9, Mueller discloses that the amount of silica nanoparticles is from about 1 to about 5 weight % (column 2, lines 28-32).

18. As to claim 14, Mueller discloses a list of optional additives, including polishing accelerators (column 4, lines 23-26) such as amino acids (column 4, lines 60-65).

Because these additives are optional, Mueller includes an embodiment in which amino acids are not present.

19. As to claim 15, Mueller discloses that the particle size range of the nanoparticles is between about 10 and about 100 nanometers (column 3, lines 9-14, lines 19-24).

20. As to claim 16, Mueller discloses that the particle size range of the nanoparticles is between about 15 and about 50 nanometers (column 3, lines 9-14, lines 19-24).

21. As to claim 17, Mueller discloses a list of optional additives, including surfactants, polymeric stabilizers or other surface active dispersing agents, pH adjusters, regulators, buffers, or polishing accelerators (column 4, lines 23-26). Because these additives are optional, Mueller includes an embodiment in which none of the additives are present.

22. As to claim 20, Mueller discloses that the nanoparticles are alumina (column 2, lines 49-51, lines 57-58).

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23. As to claim 24, Mueller discloses that the nanoparticles are zirconia (column 2, lines 49-51).

24. As to claim 26, Mueller discloses that the nanoparticles are magnesia (column 2, lines 49-50, lines 57-58).

25. As to claim 27, Mueller discloses that the nanoparticles are titania or yttria (column 2, lines 49-50, lines 57-58).

26. As to claim 28, Mueller discloses that the nanoparticles are tin oxide (column 1, lines 14-16).

27. As to claim 29, Mueller discloses an aqueous composition for chemical mechanical planarization of a shallow trench isolation film using a fixed abrasive pad, the composition comprising: (a) from about 0.2 to about 10 weight % of abrasive nanoparticles (column 2, lines 16-18) having an average particle size of between about 10 and about 100 nanometers (column 3, lines 9-14, lines 19-24); and (b) from about 90 to about 99.8 weight % of water (column 2, lines 16-18; column 5, lines 13-17); wherein the pH of the composition is between about 9 and 12 (column 5, lines 18-21; *see also* Wolf IV, page 369), and the composition does not comprise polyelectrolytes.

28. Claim 10 is rejected under 35 U.S.C. 102(b) as being anticipated by Picardi et al. (U.S. Patent No. 5,891,205).

29. As to claim 10, Picardi discloses an aqueous composition, comprising: (a) from about 0.2 to about 10 weight % of abrasive nanoparticles (column 6, lines 3-11) having an average particle size of between about 10 and about 200 nanometers (column 5, lines 20-23, lines 34-37); and (b) from about 90 to about 99.8 weight % of water (column

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6, lines 3-11); wherein the pH of the composition is between about 3 and about 5 or between about 9 and about 12 (column 1, lines 54-60; see *a/so* Wolf IV, page 369), and the composition does not comprise polyelectrolytes. Picardi further discloses that the nanoparticles are ceria and silica in a ratio of between about 10:1 and about 1:10 ceria:silica (column 4, lines 21-26).

***Claim Rejections - 35 USC § 103***

30. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

31. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

32. Claims 14 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mueller.



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33. As to claim 14, Mueller does not expressly disclose that the composition does not comprise an amino acids additive. However, Mueller teaches a list of optional additives, including polishing accelerators (column 4, lines 23-26) such as amino acids (column 4, lines 60-65). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to omit a polishing accelerator if that additive is not desired. One who is skilled in the art would be motivated to minimize the cost of wafer processing, including limiting the number of additives in a slurry.

34. As to claim 17, Mueller does not expressly disclose that the composition does not does not comprise any other ingredients. However, Mueller teaches a list of optional additives, including surfactants, polymeric stabilizers or other surface active dispersing agents, pH adjusters, regulators, buffers, or polishing accelerators (column 4, lines 23-26). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to omit additives that are not desired or a composition does not comprise any other ingredients. One who is skilled in the art would be motivated to minimize the cost of wafer processing, including limiting the number of additives in a slurry.

35. Claims 18-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Picardi.

36. As to claim 18, Picardi discloses that the average particle size of the ceria nanoparticles being less than about half the average particle size of the silica nanoparticles (column 5, lines 20-23, lines 34-37). Picardi does not expressly disclose that a substantial majority of the nanoparticles are silica nanoparticles coated with a

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plurality of smaller ceria nanoparticles. However, because Applicants' claimed particle sizes ranges for silica and ceria are within Picardi's average particle sizes ranges, similar results, such as a substantial majority of the silica nanoparticles coated with a plurality of smaller ceria nanoparticles, would be expected.

37. As to claim 19, Picardi discloses that the nanoparticles are silica nanoparticles having an average particle size of between about 10 and about 50 nanometers (column 5, lines 34-37) and the ceria nanoparticles having an average particle size between about 1 and about 5 nanometers (column 5, lines 20-23). Picardi does not expressly disclose that a substantial number of the silica nanoparticles are substantially coated with ceria nanoparticles. However, because Applicants' claimed particle sizes ranges for silica and ceria similar results are within Picardi's average particle sizes ranges, similar results, such as a substantial number of the silica nanoparticles substantially coating the ceria nanoparticles, would be expected.

38. Claims 11 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mueller in view of Grover et al. (U.S. Patent No. 5,759,917).

39. As to claim 11, Mueller discloses a composition comprising a substantially water-soluble surfactant (column 4, lines 22-25). Mueller does not expressly disclose that the concentration of the surfactant is from about 0.3 to about 3 weight %. Grover teaches that surfactants are used to stabilize a polishing slurry against settling and flocculation (column 6, lines 38-39). Moreover, Grover teaches, the amount of surfactant should be enough to achieve stearic stabilization and will vary depending upon the type of surfactant and the surface of the metal oxide abrasive (column 6, lines 50-54), with a

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general range of 0.001% to 10% by weight (column 6, lines 58-60). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a concentration of surfactant from about 0.3 to about 3 weight %. One who is skilled in the art would be motivated to achieve a stable polishing slurry.

40. As to claim 13, Mueller discloses that the composition comprises a substantially water-soluble anionic or nonionic surfactant (column 4, lines 22-25, lines 28-30).

Mueller does not expressly disclose that the concentration of the surfactant is from about 0.3 to about 3 weight %. Grover teaches that surfactants are used to stabilize a polishing slurry against settling and flocculation (column 6, lines 38-39). Moreover, Grover teaches, the amount of surfactant should be enough to achieve stearic stabilization and will vary depending upon the type of surfactant and the surface of the metal oxide abrasive (column 6, lines 50-54), with a general range of 0.001% to 10% by weight (column 6, lines 58-60). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a concentration of surfactant from about 0.3 to about 3 weight %. One who is skilled in the art would be motivated to achieve a stable polishing slurry.

41. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mueller in view of Grover, in further view of Wolf IV.

42. As to claim 12, Mueller does not expressly disclose that the wafer is a fixed pattern wafer. However, Wolf IV teaches that chemical mechanical polishing is conventionally applied to wafers with a fixed pattern, such as metal layers in intermetallic dielectric films (pages 313-14; Figure 8-1). Therefore, it would have been

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obvious to one of ordinary skill in the art at the time the invention was made to polish a fixed pattern wafer. One who is skilled in the art would be motivated to apply chemical mechanical polishing to a fixed pattern because the technique is known to accomplish the task of polishing the fixed pattern wafer.

43. Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mueller, in view of Wolf et al., *Silicon Processing for the VLSI Era*, Vol. 1, Lattice Press (1986) ("Wolf I").

44. As to claim 21, Mueller does not expressly disclose that the film is a blanket film. However, Wolf I teaches that a wide variety of thin films are blanket deposited, using chemical vapor deposition, during semiconductor fabrication (page 161). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to deposit a blanket film. One who is skilled in the art would be motivated use a commonly applied technique, the blanket deposition of thin films, in fabricating a semiconductor device.

45. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mueller in view of Li et al. (U.S. Patent No. 6,620,215).

46. As to claim 22, Mueller does not expressly disclose that the nanoparticles are polymers. However, Li discloses a chemical mechanical polishing slurry that uses an organic resin as an abrasive (column 3, lines 23-30). Moreover, Li teaches that resinous abrasive particles can be tailored for functionality, for greater control over the abrasive particle-surface interaction (column 3, lines 33-35) and that the decreased hardness of the abrasive particles reduces surface scratching (column 3, lines 38-40).

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Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use polymer nanoparticles. One who is skilled in the art would be motivated to adopt a method with greater control over abrasive particle-surface interactions and reducing the number of surface scratches.

47. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mueller in view of Li, in further view of Wolf IV.

48. As to claim 23, Mueller does not expressly disclose that the polishing pad is a fixed abrasive pad with cylindrical, pyramidal, hexagonal, square, or rectangular structures. Wolf IV teaches that fixed abrasive pads with cylindrical, pyramidal, hexagonal, square, or rectangular structures are conventional (page 383, Figure 8-64). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a fixed abrasive pads with cylindrical, pyramidal, hexagonal, square, or rectangular structures. One who is skilled in the art would be motivated to use a fixed abrasive pad with a conventional structure, because such pads are known to accomplish the task of polishing.

49. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mueller in view of Towery et al. (U.S. Patent No. 6,270,395).

50. As to claim 25, Mueller does not expressly disclose that the nanoparticles are hematite. However, Towery teaches that iron oxide (or hematite) (column 12, lines 40-42, line 45) is a common abrasive used in abrasive particle slurries (column 12, lines 22-29) for chemical mechanical polishing (column 1, lines 5-8). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made

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to use hematite nanoparticles. One who is skilled in the art would be motivated to use a commonly use abrasive, known to accomplish the task of chemical mechanical polishing.

### ***Conclusion***

51. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Wang et al. (U.S Patent No. 6,316,365) discloses a chemical mechanical polishing slurry for a fixed polishing pad with metal oxides including alumina, silica, titania, ceria, zirconia, and magnesia. Komada et al. (U.S. Patent No. 6,027,554) discloses a polishing composition with metal oxides. Oshima et al. (U.S. Patent No. 6,620,216) discloses a polishing composition with 200 nm particles of aluminum oxide, magnesium oxide, titanium oxide, cerium oxide, zirconium oxide, or silica. Tokarz et al. (U.S. Patent Appl. Pub. No. 2003/0118824) discloses a polishing composition with cerium oxide coated silica particles.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric B. Chen whose telephone number is (571) 272-2947. The examiner can normally be reached on Monday through Friday, 8AM to 4:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine G. Norton can be reached on (571) 272-1465. The fax phone

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number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

EBC

June 23, 2005

*EBC*

**NADINE G. NORTON  
SUPERVISORY PATENT EXAMINER**

*Norton*